Session 3: Suspended/bedded sediments and Water Quality Management
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# Conditional probability analysis approach for identifying biological threshold of impact for sedimentation

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The need for scientifically-defensible water quality standards for non-point source pollution control continues to be a pressing environmental issue. The probability of impact at differing levels of non-point source pollution was determined using the biological response of in-stream organisms empirically obtained from a statistical survey. A conditional probability analysis was used to calculate a biological threshold of impact as a function of the likelihood of exceeding a given value of pollution metric for a specified geographic area. Uncertainty and natural variability were inherently incorporated into the analysis through the use of data from a probabilistic survey. Application of this approach with survey data (probability-based sample design) allows extrapolation of the results to the entire geographic area and eliminates possible bias in site selection. Data from wadable streams in the mid-Atlantic area and the Coast Range Ecoregion in Oregon were used to demonstrate the approach. Benthic macroinvertebrate community index values (EPT taxa richness) were used to identify impacted stream communities. Several surrogate indicators of sedimentation (e.g., percent fines in the substrate, mean particle size, and turbidity) were selected. For each indicator, thresholds of impact were identified by at least 2 different techniques. These threshold of impact values were consistent with existing literature from laboratory and field studies on the impact of sediments on aquatic life in freshwater streams. All results were different than values determined from current regulatory guidance. Finally, it was illustrated how these thresholds could be used to develop criterion for protection of aquatic life in streams. Although final development of water quality standards requires a management decision, the development of scientifically-defensible approaches for establishing criteria based on significant deviations from expected community condition across a wide range of geographic conditions is a useful first step in the process.